

Notes and Takeaways from Sessions Attended at the 2015 Water Resources Conference

Guy Mueller, City of Crystal Commissioner
Bassett Creek Watershed Management Commission

NOAA Atlas 14 Rainfall Depth, NRCS Rainfall Distributions, and Dimensionless Unit Hydrographs

Amanda Smith

NOAA Atlas 14, published in 2013, has updated rainfall information for 405 MN data sets. MN now uses the MSE 3 rainfall distribution for the entire state and a peak rate hydrograph factor of 400 for determining discharge rates.

Determining Effective Impervious Area for Stormwater Runoff in Ungauged Urban Watersheds

Ali Ebrihimian and John S. Guliver

Effective impervious area (EIA) instead of total impervious area (TIA) provides a more accurate way to estimate runoff volumes. EIA is comprised of the impervious areas that are hydraulically (directly) connected to the storm sewer system. EIA average is about 20% and the EIA/TIA ratio is about 40%. The authors presented a method for using GIS, soil information, TIA, and NRCS-Runoff Curve numbers to estimate EIA. NRCS is the USDA National Resources Conservation Service. To reduce runoff, convert EIA to non-effective IA (=TIA-EIA) by breaking the hydraulic connection. Example: Install a trench drain at the end of a driveway to divert runoff to a raingarden.

Designing a City for Zero Stormwater Discharge

Brett Emmons and Carl Almer, Emmons and Oliver Resources (EOR)

A 3000-acre basin-shaped, mixed commercial-residential development site in Inver Grove Heights had no natural stormwater outlet. It was hydrologically land locked. Typical natural area has 10% runoff. This area had 0%. Pumping the added runoff from the new development all the way to the Mississippi through large pipes would have been cost prohibitive. Pumping and dumping it into a nearby chain of lakes was unacceptable. Goal: New Development with Zero Discharge. No pipe-and-pump “solutions” were allowed.

Instead, the IGH development used LID (low impact development) solutions to achieve zero runoff. The LID systems, which mimicked natural hydrology and maximized infiltration, saved \$18,000,000 in capital costs and \$30,000,000 in life cycle costs, including the costs of sediment removal from WQ ponds, because no WQ ponds were required. It also added green street and open space amenities, replenished ground water supplies, and earned EOR the 2015 National Award for Excellence in Engineering. LID methods utilized included curb cuts, porous pavement, permeable pavers, rain gardens, flexible zoning side-yard and setback requirements to create clustered development and more open space, and also innovative parking lot requirements. Boulevard medians, instead of being paved or landscaped mounds, became linear rain gardens fed by curb cuts. Many smaller BMPs were integrated into the site rather than larger downstream BMPs. This development managed stormwater runoff at its causal source, not its symptoms at the end of the pipe.

Could we do more to promote permeable pavers, tree trenches, and the like in our watershed’s parking lots? More rain gardens even in our clayey soils—with soil amendments or infiltration conduits so that they would really work? Would there be any merit in having the new traffic circles on Douglas Drive in Golden Valley built not as paved/landscaped mounds but as landscaped bioretention basins? Will our

new website include content or links to DIY information and citizen stewardship opportunities—rain gardens, rainwater capturing systems, lawn alternatives, keeping leaves and grass clippings off the streets, adopt-a-drain, etc.? We have a section for “For Developers.” How about a section “For Citizens (or Residents)” —what they can do to help and how they can get involved?

Mississippi Watershed Management Organization’s New Headquarters: The Transformation of an Urban Industrial Site.

Keith Leuthold and Doug Snyder

The MWMO design team used a variety of proven and experimental BMPs to achieve zero runoff from the new headquarters site on the banks of the Mississippi and also to capture runoff from the site’s two neighbors. Visitors are introduced to the principles and techniques of stormwater management as they are guided along a landscaped walk to the Mississippi River below. BMPs include shared parking with the bar next door, grass swales, partial green roof, large cistern with a flapper valve, sunken tree grove and boxes, sculptural scuppers and downspouts, and comparative side-by-side buried filter systems—spent lime, iron oxide, and sand (?). Spent lime has been proven to be effective in removing phosphorus while allowing more thru-put (less head loss) than iron oxide. The attractive building makes maximum use of natural light and affords views of the “Stormwater Park” and the river. Worthy of a visit by all!

Stormwater Reuse for Irrigation of Edison High School Football Field

Dan Edgerton and Mark Statz

The irrigation of the football field using reclaimed stormwater is just one of several components of Edison High School’s Green Campus Initiative, which collaboratively involves a variety of stakeholders. Tree trenches and permeable pavers were recently installed; performance evaluation for this component will be undertaken soon. The football field was improved--soil amended with sand—and is now irrigated with water captured from the rooftop and parking lot, collected in an underground vault and pumped to the field. Debris must be filtered/settled out, so roof-top irrigation water sources are best. In the future, the plan is to use stormwater for the toilets, too, but code clarifications/revisions are needed. When gray water is used for irrigation, a 3:1 ratio of gray water-to-green is needed. Monitoring will be done at various outlets to assess the performance of the systems, including the volumes of water captured and reused, which will be displayed online as well as onsite for educational purposes. The presenters mentioned the availability of a stormwater worksheet from the Met Council.

Stream Channel Restoration to Improve Dissolved Oxygen—Clearwater River Watershed District

Rebecca Kluckhohn

Stream restoration typically focuses on bank stabilization and riffle-pool construction to improve habitat and reduce erosion. However, limiting improvements along these lines may miss opportunities to increase dissolved oxygen and biotic integrity through “re-meandering” or other channel naturalization strategies. The Clearwater River’s Kingston wetland complex had a linear, single stage ditch cut through it, which was conveying phosphorus to downstream lakes. The stream was impaired for DO and E. coli, and a downstream lake also was impaired. The Watershed District abandoned the existing single-stage linear ditch and replaced it with a new sinuous, two-stage (stepped) channel, which had one curve immediately following the other. With the completion of the project, what was once straight had now become a series of curves. In addition to this re-meandering, the District installed a sediment trap at the

inlet and a limestone berm to filter out the phosphorus. Before and after water samples showed dramatic improvements in DO, phosphorus, and biotic indices, both in the channel's waters and in the downstream lake. Native plants also were beginning to re-establish themselves on their own, thus eliminating the need for re-vegetation work. Based on the photos shown, what was once a fairly grim sight is now an appealing natural area full of wildlife and water quality at nearly pre-agrarian levels.

Stream Restoration in Hardwood Creek to Address Biotic Impairment—Rice Creek Watershed District
Matt Kocian and Walter Eshenaur

The Rice Creek Watershed District used a re-meandering strategy to address the biotic and sedimentation impairments of Hardwood Creek. Engineers in the 1960s had installed a linear ditch as a shortcut to bypass the historical meandering channel. The current project, finalized in 2014, filled in the 1960's linear ditch and restored the original, natural channel. The restored meandering channel included a 2-stage design with flood plain bench, riffles, root wads, bed gravel, and bank vegetation. In a segment farther upstream, the District kept the ditch in its current alignment but reworked the profile to establish a two-stage channel with floodplain bench. Cattle-crossing improvements in this upstream segment included a corduroy of concrete planks, similar to a boat launch, installed across the stream with the planks aligned parallel to the current. Before and after survey data show a more stable channel, reduced TSS and BOD (meeting goals), increased DO (above 5), improvements in stream health and presence of macroinvertebrates, and reduced nutrient delivery to Peltier Lake. The RCWD accommodated a property owner who wanted to retain a large, picturesque willow along the creek. The solitary, iconic tree was left intact and protected with berms. Its presence, in the opinion of the engineers, did not interfere with the performance of the restoration.

Lowertown Ballpark (CHS Field): Managing Runoff Differently—Capital Region Watershed District
West Saunders-Pearce and Nate Zwonitser

A 27,000 gallon cistern collects rainwater for irrigation and the flushing of toilets. The fully automated system has a vortex filter, settling/holding tank, 1 micron absolute bag filtration, UV treatment at the outlet, and potable water backup. Must meet E. coli, turbidity, and odor standards; so far so good. Other BMPs include rain gardens, bio swales, and tree trenches. Emphasis on education and art/illustrations that inform the public/fans. Challenges included multiple owners and buildings. Also, with potable water at a mere \$0.003/gallon, the presenter said that the economics of SW reuse are not overly compelling.

Understanding the Role of Urban Trees in the Management of Nutrients in Stormwater
Benjamin Janke

Although trees take up atmospheric CO₂, reduce the urban heat island effect, and reduce volumetric runoff, the tree canopy, especially the portion extending over streets, is a significant contributor to stormwater nutrient loading. Nutrient loading in wooded urban areas spikes during snowmelt, leaf-out, and leaf-fall periods. Policy implication: Cleanliness is next to godliness! Sweep the streets and do so with keen consideration for the timing of the sweeping operations, the density of tree canopies, and the tree species.

Using Natural Channel Design . . . the Stewart River Natural Channel Design Restoration Project—Lake County Soil and Water Conservation District

Ann Thompson, Dan Schutte, et al.

The 2012 flood wreaked havoc on this Northshore river and dramatically altered course of the channel's course. The resultant damages, which included bank erosion, sediment loading, channel widening, and increased temperatures, threatened the river's native brook trout populations. To more broadly restore the stream's functions and its stability, the LCSWCD engineering team embraced a comprehensive, "holistic" approach that took into account ecological and geomorphic considerations, including the restoration of the channel's flood plain connectivity. "Fluvial geomorphology" concerns a channel's shape longitudinally, laterally, and vertically and also a river's dynamic response to natural or manmade influences. Armoring banks, whether with hard riprap or "soft" plant materials, while ignoring geomorphological considerations, may prove catastrophically unwise, and the presenters showed several slides of failed riprap systems. To dissipate flow energy, sinuous or step flow strategies may be used. LCSWCD hired a geomorphologist to assist with this project and also to teach a course on geomorphology to 40 water resource professionals.

Geomorphic Characteristics, Processes, and Response of Duluth-Area Streams

Christopher Ellison and Faith Fitzpatrick, USGS

Ellison and Fitzpatrick analyzed before-and-after photographs and other data on Duluth area streams impacted by the 2012 flood. The flood left the meandering streams in the more gradually sloped upland areas largely intact. On the steeper slopes next to Lake Superior, the changes were dramatic. Pre-flood, shaded channels were widened and scoured, and the once habitat-friendly pools were filled in with smaller gravel debris. Much repair and restoration work remains to be done.

Ravine Erosion, Base Flow and Private Property: an Urban Stormwater Management Trifecta—Capitol Region Watershed District.

Anna Eleria and Todd Shoemaker

This was a difficult project on a very steep slope that drew runoff from ground seepages as well as surface waters. The project required flexibility and cooperation among engineer, contractor, property owners, and the CRWD. Rain and mud hampered the excavation work and one worker lost his finger in an accident, but was back on the job the next day. On the steepest part of the bluff, they conveyed the runoff through pipes. Elsewhere, they employed rock grade control structures, brush bundles, vegetated riprap, native plant revegetation, and a stormwater basin at the base of the bluff. Results: Annual sediment reductions of 30 tons and annual P reductions of 10 pounds.

Exhibitors—Engineering Firms, Equipment Suppliers, Etc.

There were lots of interesting products and equipment on display. Some of them, I thought, although not too glamorous, might be potentially useful in the BC watershed. Here are some selected examples:

- Gravity separators that could be installed in existing manholes
- Impressive new drainage paver systems suitable for parking lots and plazas
- Baffle boxes to capture and the dry-store solids, sediment, and debris. I would like to see something like this installed on the North Branch of BC just upstream of Basset Creek Pond. The Pond's water quality would be visibly improved and the baffle box might eliminate or significantly delay the need for future dredging of the pond.

One of the engineering firms exhibiting at the conference promoted their company as “using nature as infrastructure.” This motto, in four short words, expressed the critical values that I believe effective stormwater management must embrace: to design with nature instead of against it, to respect the natural course of channels and riparian habitats instead of altering them, and--when alterations are required—to design improvements in ways that mimic, replicate, or restore natural systems.